MODULAR PLATFORM SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application No. 60/400,827, filed 02 August 2002.

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BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a modular platform system and a method of installing the modular platform system, wherein a plurality of operatively connected platform modules can be quickly and efficiently suspended with respect to a working location. More specifically, this invention relates to a modular platform system and method of installing the system wherein a plurality of platform modules can be installed and suspended with respect to a bottom or underside support surface of a bridge structure or other structure, for example.

Description of Prior Art

Many deck structures are supported by an angle bracket having one leg structurally welded to an edge portion or an underside of a horizontal flange of a steel stringer, a steel plate, a girder, or another suitable steel primary structural member. Deck pans or other suitable deck panels of these deck structures are individually positioned between opposing angle brackets which are welded into place in the field. Each deck pan is positioned upon horizontal flanges of such field-installed opposing angle brackets. The deck pan is then secured with a sheet metal screw or a weld, also at the job site.

With these deck framing systems, each vertical height adjustment to vary the elevation of the top of the deck pan requires labor-intensive field adjustments, often accomplished with welded connections. Further, many of these deck framing systems have welded connections or metal fasteners exposed beneath

the deck structure.

Thus, a problem associated with deck framing systems and methods therefor that precede the present invention is that they do not facilitate quick installation of the deck panels by permitting pre-placement of the securement means prior to installation of the deck panels, and movement of the securement means as the deck panels are installed.

Still a further problem associated with deck framing systems and methods therefor that precede the present invention is that they do not facilitate efficient transportation to a job site in a manner that saves shipping space and thereby saves time, energy and money.

Yet an additional problem associated with deck framing systems and methods therefor that precede the present invention is that they do not enable efficient assembly and erection of the deck framing system.

Still a further problem associated with deck framing systems and methods therefor that precede the present invention is that the vertical height of each deck panel structure cannot be quickly adjusted using simple mechanical elements to accommodate the varying dimensional characteristics of the prefabricated deck panel structures.

For the foregoing reasons, there has been defined a long felt and unsolved need for a modular platform system and method that can be quickly and easily suspended and removed from a structure in order to maintain and/or repair the

structure, inexpensive to manufacture and adjustable to accommodate a variety of prefabricated parts of differing sizes and dimensions.

SUMMARY OF THE INVENTION

It is one object of this invention to provide a platform module for use in a modular platform system that can be suspended with respect to a structure, for example an underside support surface of a bridge construction.

It is another object of this invention to provide a modular platform system that is easily suspended from a structure in order to access areas of the structure for maintenance and/or repair.

It is another object of this invention to provide a modular platform system that can be easily removed from the structure after scheduled maintenance and/or repair.

It is another object of this invention to provide a modular platform system having containment means for containing debris, including hazardous materials, such as lead paint, removed from a structure during maintenance and/or repair procedures.

The above and other objects of this invention are accomplished with a platform module suspendable from a structure. The platform module includes a first framing member suspended with respect to the structure and a second framing member suspended with respect to the structure and mounted with respect to the first framing member. At least one deck panel is positioned between the first framing

member and the second framing member and suspended with respect to the structure to provide a working surface for the contractors working on the structure. The platform modules are removably mounted or suspended with respect to the structure using adjustable suspension members connected or attached to the first framing member and the second framing member.

The modular platform system includes a second platform module that is movably connected to the first platform module so that it is movable between a first position operatively connected to the first platform module and a second or extended position wherein the second platform module is linearly aligned with the first platform module and suspended with respect to the structure. For example, at least one and preferably a plurality of channel trolleys are mounted to each framing member of the first platform module. The channel trolleys include rotatable wheels that can be positioned within a channel formed by the corresponding framing member of the second platform module to allow the second platform module to move with respect to the first platform module suspended from the structure.

The second platform module can be the same or similar to the first platform module, or different. Preferably, the second platform module includes a first framing member operatively connected to the first platform module first framing member and a second framing member operatively connected to the first platform module second framing member. A deck panel is positioned between the first framing member and the second framing member. The second platform module can be

removably mounted or suspended with respect to the structure using adjustable suspension members attached to each framing member, in the second position. In the second position, the first platform module and the second platform module can be connected or secured in linear alignment using any suitable mechanical connection known to those having ordinary skill in the art. The term "linear alignment" as used throughout this specification refers to alignment of abutting framing members generally parallel in a direction along a width of the structure so that the upper surfaces of adjacent platform modules are flush.

The deck panel may be any suitable material depending upon the intended use for the platform module. For example, the deck panel may be made of wood panels or wood composite materials, concrete, metal, fiberglass or other suitable insulating materials, composites and combinations thereof. Further, the deck panel may provide a barrier to vapor, heat, and/or solvents, for example. The deck panel may have any suitable size to span between the first framing member and the second framing member along a length of the framing members.

The modular platform system can be easily installed to suspend from a structure, such as a support structure of a bridge construction. The suspended modular platform system of the present invention preferably comprises a plurality of operatively connected platform modules stacked or otherwise configured in a compact or efficient manner. Alternatively, independent platform modules may be connected together to form the suspended modular platform system. The platform modules can

be raised from a ground surface or can be lowered from a surface of the bridge structure to position the suspended modular platform system with respect to the underside support surface of the bridge construction.

The modular platform system can be hoisted using a crane or other suitable machinery and suspended over an edge portion of the bridge. The modular platform system is positioned with respect to the underside support surface of the bridge structure and the first platform module is secured in position with respect to the support surface using at least one support member.

In one preferred embodiment of this invention, the first and second framing members are suspended from the support surface of the structure. The framing members can be securely connected to the stringers of the bridge using suitable beam clamps, for example, and run or extend perpendicular to the stringers, i.e. towards the centerline of the bridge. A preferred beam clamp is available from Multuloc Corp. located in Park Ridge, Illinois, U.S.A. under the trade name Tuloc beam clamp. Preferably, the second framing members are suspended from the support surface and run or extend parallel with the first framing members. In certain embodiments of this invention wherein the structure and/or the support surface has a general arcuate or non-linear shape, the first and second framing members may not run or extend in a parallel direction. Rather, in such an embodiment, the framing members may converge or diverge with respect to each other as the framing members approach the centerline of the bridge.

The first platform module is suspended with respect to the structure. A second platform module is extended from a first position operatively connected to the first platform module to a second position linearly aligned with the first platform module and suspended with respect to the structure. The second platform module can be connected to the first platform module in the second position using any suitable mechanical connection. Each of the platform modules are suspended with respect to the structure using at least one adjustable suspension member attached to the first framing member and at least one adjustable suspension member attached to the second framing member. Preferably, each suspension member is removably mounted with respect to a support surface of the structure, such as a support beam or stringer.

In one preferred embodiment of this invention, a second modular platform system can be constructed laterally adjacent to the first modular platform system and suspended with respect to the structure. The second modular platform system can be connected to the first modular platform system.

Additionally, where the structure and/or the support surface slopes in a lateral direction generally perpendicular to the centerline of the bridge, the vertical distance of adjacent panel structures with respect to the support surface may be adjusted to form a level panel structure surface. Alternatively, the adjacent panel structures may form steps or a "stepped" panel structure surface. For example, the framing members may be adjustably connected to the support surface using threaded rods and/or turn buckles.

After the repair and/or repainting project is completed, the modular platform system is easily removed from the structure and can be reused. The extended platform modules can be retracted from the second position to the first position after the suspension members are disconnected from the support stringers. The retracted modular platform system can then be hoisted up to the upper surface of the structure using a crane or other suitable machinery and easily loaded onto a truck for removal from the work location. Any number of modular platform systems can be used to form a suitable platform, depending upon the size of the job.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and objects of this invention will be better understood from the following detailed description when taken in view of the drawings wherein:

Fig. 1A is a side view of a modular platform system comprising a platform module suspended with respect to a structure, according to one preferred embodiment of this invention;

Fig. 1B is a side view of a modular platform system comprising a platform module suspended with respect to a structure, according to one preferred embodiment of this invention;

Fig. 2 is a side view of a platform module removably connected with respect to a structure, according to one preferred embodiment of this invention;

Fig. 3A is a side view of a platform module removably connected with

respect to a structure, according to one preferred embodiment of this invention;

Fig. 3B is a front view of a platform module removably connected with respect to a structure, according to one preferred embodiment of this invention;

Fig. 3C is a front view of a platform module removably connected with respect to a structure, according to one preferred embodiment of this invention;

Fig. 4 is a perspective view of a channel trolley, according to one preferred embodiment of this invention;

Fig. 5 is a perspective view of a channel trolley, according to one preferred embodiment of this invention;

Fig. 6 is a front view of a modular platform system comprising a plurality of operatively connected platform modules, according to one preferred embodiment of this invention;

Fig. 7 is a side view of a modular platform system comprising a plurality of operatively connected platform modules in a first position and a first platform module removably suspended from adjacent stringers of the structure, according to one preferred embodiment of this invention;

Fig. 8 is a side view of a modular platform system comprising a plurality of platform modules each in a second or extended position, according to one preferred embodiment of this invention;

Fig. 9 is a front view of a platform module connected to adjacent platform modules and suspended with respect to a structure, according to one

preferred embodiment of this invention;

Fig. 10 is a front view of a platform module connected in a stepped fashion to adjacent platform modules and suspended with respect to an angled or sloped bottom support surface of a structure, according to one preferred embodiment of this invention;

Fig. 11 is a perspective view of a platform module, according to one preferred embodiment of this invention;

Fig. 12 is a perspective view of a platform module, according to one preferred embodiment of this invention;

Fig. 13 is a perspective view of a modular platform system having a guard rail system, according to one preferred embodiment of this invention;

Fig. 14 is a front view of a guard rail system post secured within a framing member, according to one preferred embodiment of this invention; and

Fig. 15 is a front view of a modular platform system comprising a first platform module operatively connected to a second platform module, according to one preferred embodiment of this invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

The modular platform system 10 of the present invention can be suspended with respect to a structure to support a dynamic and/or static load with respect to an underside surface of the structure. For example, the structure may comprise a bridge construction having a plurality of support beams or stringers

extending along a length of the bridge to form support surfaces. In order to repair and/or paint the bridge, particularly an underside or bottom support surface of the bridge, modular platform system 10 can be installed to suspend from the underside of the bridge to allow access to desired areas of the structure. Such repair may include slab demolition, sand or shot blasting the supporting steel and painting the steel structure. Additionally, modular platform system 10 can be adapted to contain debris, such as concrete pieces, removed from the bridge to prevent the debris from falling to the ground or into the water. In one preferred embodiment of this invention, modular platform system 10 includes a containment means for containing environmentally hazardous or toxic material, such as lead-based paint, after the hazardous or toxic material has been removed from the structure. The containment means prevents the environmentally hazardous or toxic material from entering into the atmosphere. Modular platform system 10 can be constructed and/or installed from the ground, where the structure spans a street or highway, or can be constructed and/or installed from the structure itself, where the structure spans a body of water, for example.

Modular platform system 10 can span any suitable distance, for example about 10 feet to at least about 100 feet, in order to allow access to the entire underside of the bridge structure or other structure. Further, modular platform system 10 may extend past the edge portion of the structure for easy access to materials and/or a side portion of the structure. It is apparent to those skilled in the art that the modular

platform system of the present invention can be adapted to span any desired distance with respect to the structure.

In one preferred embodiment of this invention, modular platform system 10 comprises a plurality of platform modules 12. Each platform module 12 is suspendable with respect to a structure 100, such as a bridge structure. For example, each platform module 12 may be mounted or secured to at least one support surface, such as a support beam or stringer positioned on an underside or bottom surface of the bridge structure. The support stringers are typically positioned generally parallel to a longitudinal centerline of the bridge structure along a length of the bridge.

Referring to Figs. 1A-3C, platform module 12 comprises a first framing member 14 suspended with respect to the structure. For example, first framing member 14 may be suspended to extend or span between adjacent support stringers. Preferably, a second framing member 16, the same or similar to first framing member 14, is suspended with respect to the structure and mounted with respect to first framing member 14. For example, second framing member 16 can be suspended to extend or span between the adjacent support stringers and extend or run generally parallel to first framing member 14. It should be apparent to those skilled in the art and guided by the teachings herein provided that, depending upon whether the bridge section is straight or curved, first framing member 14 may or may not be parallel to second framing member 16. Further, in order to compensate for curvature in the bridge structure, adjacent modular platform systems 10 may be positioned in a skewed

position, a fanned position or a straight position with respect to each other.

As shown for example in Figs. 3B and 3C, at least one deck panel 18 is positioned between first framing member 14 and second framing member 16 and suspended with respect to the structure 100. Deck panel 18 may comprise any suitable material having sufficient strength to support contractors, materials, tools and debris. Suitable deck panel materials include metal sheets such as shown in Fig. 11, wood, concrete, composite materials including insulating materials such as shown in Fig. 12, and combinations thereof, depending upon the overall size and intended use of modular platform system 10, for example. Further, deck panel 18 may have any suitable length, width and/or thickness. In one preferred embodiment of this invention, deck panel 18 comprises a suitable material to provide a barrier or seal, such as a vapor barrier, an insulating barrier, a heat seal, or a solvent seal. Adjacent decl panels 18 positioned between first framing member 14 and second framing member 16 may be flush or may overlap with respect to adjacent deck panels 18.

In one preferred embodiment of this invention, at least one suspension member 20 is used to suspend each of first framing member 14 and second framing member 16 with respect to the structure 100. Preferably, but not necessarily, a length of suspension member 20 is adjustable. Referring to Fig. 1A, at least one suspension member 20 is connected or attached between first framing member 14 and the structure 100. For example, suspension member 20 comprises a clamp or other suitable mechanical connection at a first end portion of suspension member 20 to

removably mount first framing member 14 to a support stringer 110 of the structure 100. Similarly, at least one suspension member 20 is connected or attached to second framing member 16 and removably mounted with respect to the structure.

Suspension member 20 preferably comprises a chain or cable 40 having a first connection, such as hook 42, positioned at a first end portion 44 and a second connection, such as hook 46, positioned at a second end portion 48, as shown in Fig. 1A. Hooks 42 and/or 46 allow the framing members to be suspended from the support stringers quickly and easily. Preferably, each hook 42, 46 comprises a pivot arm to allow the hook to "snap" connect with a corresponding loop fastener. Cable 40 may have any suitable length to suspend first framing member 14 and/or second framing member 16 at a desired position or distance with respect to support stringer 110. Preferably, the length of cable 40 is adjustable.

At least one loop fastener 50 is secured to first framing member 14. For example, loop fastener 50 may be threadedly connected to a bolt 52 that is secured to first framing member 14. As shown in Fig. 1A for example, a bracket 54 is in contacting relation with an inner surface of first framing member 14. Preferably, but not necessarily, bracket 54 and at least a portion of bolt 52 are positioned within a cavity 55 formed by first framing member 14. Loop fastener 50 and bolt 52 are rotatable with respect to each other to tighten or secure fastener 50 to first framing member 14.

In one preferred embodiment of this invention, a beam clamp 80 is

positioned and secured to a support beam or stringer 110, as shown in Fig. 1A. Beam clamp 80 comprises a bolt 84 connected to a bracket or transport trolley 81. A suitable transport trolley is available from Multuloc Corp. located in Park Ridge, Illinois, U.S.A. under the trademark TULOC. Bolt 84 can be connected or mounted to transport trolley 81 using a weld or a suitable mechanical connection. As shown in Fig. 1A, transport trolley 81 preferably runs generally parallel with a side edge of the stringer 110. A bottom bracket 85 is in contacting relation with a bottom surface of the stringer 110. Preferably, bottom bracket 85 is threadedly connected to bolt 84 to maintain bottom bracket 85 in contacting relation with support stringer 110. A top bracket 86 is positioned about bolt 84 and maintained in contacting relation with support stringer 110 by a nut arrangement 87. A set screw 91 is threadedly connected to top bracket 86 and rotatable with respect to top bracket 86 to secure beam clamp 80 with respect to the support stringer. Nut arrangement 87 comprises a beveled washer 90 which allows beam clamp 80 to be secured to a support beam or stringer having any suitable thickness, regardless of whether the stringer has a flat contacting surface or a sloped contacting surface.

For example, some old beams and channels have an interior flange surface with a 1 to 6 slope. Beam clamp 80 compensates for the sloped top flange surface by providing beveled washer 90 and a tolerance between bolt 84 and an aperture formed in top bracket 86 within which bolt 84 is positioned. For example, in one preferred embodiment of this invention, bolt 84 has a ½ inch diameter and the

aperture formed in the top bracket 86 has a 9/16 inch diameter. Thus, top bracket 86 has a 1 to 6 slope with respect to bolt 84 to maintain a contacting relation with the sloped flange surface of the stringer. Beam clamp 80 maintains maximum torque, and coupled with set screw 91, resists lateral forces to provide full contact at the beam edge and point contact bearing through set screw 91 while adjusting for any tolerance variances.

As shown in Figs. 1A-2, a wire or cable 88 can be connected between suspension members 20 at beam clamp 80 positioned with respect to the support stringer 110 to maintain beam clamp 80 securely connected with respect to the support stringer 110.

At least one channel trolley 70 is mounted with respect to transport trolley 81. Preferably, channel trolley 70 is positioned within a channel 83 formed by transport trolley 81. Referring further to Figs. 4 and 5, channel trolley 70 comprises at least one rotatable wheel 72. Rotatable wheels 72 are positionable within channel 83 to allow relative movement of platform module 12 with respect to the stringer 110. Suspension member 20 preferably comprises a second connection, such as hook 46, positioned at a second end portion 48, as shown in Fig. 1A. Hook 46 allows the framing members to be suspended from the support stringers quickly and easily. Preferably, each hook 46 comprises a pivot arm to allow the hook to "snap" connect with an aperture formed in channel trolley 70.

At least one loop fastener 50 is secured to first framing member 14. For

example, loop fastener 50 may be threadedly connected to a bolt 52 that is secured to first framing member 14. As shown in Fig. 1A for example, a bracket 54 is in contacting relation with an inner surface of first framing member 14. Preferably, but not necessarily, bracket 54 and at least a portion of bolt 52 are positioned within a cavity 55 formed by first framing member 14. Loop fastener 50 and bolt 52 are rotatable with respect to each other to tighten or secure fastener 50 to first framing member 14.

In one preferred embodiment as shown in Fig. 1B, a fastener 50 can be connected directly to bolt 84. Preferably, but not necessarily, fastener 50 contacts bottom bracket 85 to maintain beam clamp 80 securely fastened to the stringer 110. In this embodiment, hook 46 is easily connected to fastener 50 to suspend platform module 12 with respect to the structure. Alternatively, cable 40 can be positioned between bottom bracket 85 and the stringer so that hook 42 and hook 46 each are connected to loop fastener 50, connected to framing member 14, 16.

Beam clamp 80 allows a containment or safety system, such as a net or fence suspended with respect to the structure and/or a load bearing system, such as modular platform system 10, for supporting a load, for example contractors working on the structure, to be connected with respect to the structure.

In one preferred embodiment of this invention, each of first framing member 14 and second framing member 16 is removably suspended or mounted to the structure using beam clamp 80, as shown in Figs. 3A-3C. Beam clamp 80 comprises

a strut 82. At least one suspension member 20 is mounted or connected with respect to strut 82 which extends along a width of support stringer 110. For example as shown in Fig. 3A, a suspension member 20 is connected at first end portion 44 having a first hook 42 to a first loop fastener 50 mounted to first framing member 14 and at a second end portion 48 having a second hook 46 to a second loop fastener 50 mounted to first framing member 14. In this embodiment, at least one suspension member 20 runs through at least a portion of a channel formed by strut 82 and around at least one pin connection 93 positioned within an aperture 92 formed in strut 82. Alternatively, two suspension members 20 may be independently connected to strut 82 using pin connections 93 positioned within a desired aperture 92. Bolt 84 is connected to strut 82, for example, using a weld or a suitable mechanical connection. Bottom bracket 85 and top bracket 86 are positioned about bolt 84 and maintained in contacting relation with support stringer 110 by nut arrangement 87. Preferably, bottom bracket 85 is threadedly connected to bolt 84 to maintain bottom bracket 85 in contacting relation with support stringer 110. Set screw 91 is threadedly connected to top bracket 86 and rotatable with respect to top bracket 86 to secure beam clamp 80 with respect to the support stringer. Beveled washer 90 allows beam clamp 80 to be secured to a support beam or stringer having any suitable thickness, regardless of whether the stringer has a flat contacting surface or a sloped contacting surface.

In one preferred embodiment of this invention, strut 82 forms a plurality of apertures 92 for mounting each suspension member 20 with respect to strut 82. A

distance between the framing member and the support stringer is adjustable by selecting a desired or appropriate aperture 92 within which pin connection 93 can be secured to adjust a length of suspension member 20 positioned between strut 82 and framing members 14, 16, depending upon the physical limitations associated with the intended use of modular platform system 10. As shown in Fig. 3B, two or more suspension members 20 can be connected with respect to strut 82 to allow framing member 14, 16 of laterally adjacent platform modules 12 to be suspended with respect to structure 100.

In one embodiment of this invention as shown in Fig. 3C, a strut 95 can be connected to adjacent beam clamps 80. Strut 95 forms a channel within which at least one channel trolley 70 can be movably positioned. At least one suspension member 20 can be connected to channel trolley 70 to suspend platform module 12 with respect to structure 100. Channel trolley 70 comprises rotatable wheels 72 which can be movably positioned within the strut channel to allow suspended platform module 12 to move with respect to the structure.

Referring to Figs. 6-8, in one preferred embodiment of this invention, modular platform system 10 comprises a plurality of operatively connected platform modules 12 which are suspended or supported with respect to the structure. Each platform module 12 comprises a first framing member 14, a second framing member 16 and at least one deck panel 18 positioned between first framing member 14 and second framing member 16 and suspendable with respect to structure 100, as shown

for example in Fig. 6.

A second platform module 12' is movable with respect to the first platform module 12 between a first position operatively connected to first platform module 12 and a second or extended position linearly aligned with first platform module 12. Preferably, second platform module 12' is the same or similar to first platform module 12. Second platform module 12' comprises a first framing member 14' movably mounted to at least one channel trolley 70 secured or mounted with respect to first platform module first framing member 14 and a second platform module second framing member 16' movably mounted to at least one channel trolley 70 secured or mounted with respect to first platform module second framing member 14. Rotatable wheels 72 are positionable within a channel 75, 76 formed by the second platform module framing member 14', 16', respectively.

In the second position, second platform module 12' is removably suspended with respect to the structure from a support beam or stringer for example, and in linear alignment with platform module 12, using at least one suspension member 20 attached to first framing member 14' and at least one suspension member 20 attached to second framing member 16'. Further, a connecting bracket or other suitable mechanical connection can be used to connect first framing member 14' in linear alignment with first framing member 14 and second framing member 16' in linear alignment with second framing member 16. In the second position, deck panel 18', positioned between first framing member 14' and second framing member 16', is

suspended with respect to the structure.

Preferably, as shown in Fig. 7, first framing member 14 and corresponding second framing member 16 extend between the first support stringer 110 and a second support stringer 110' of the structure, generally parallel to the first support stringer 110. It is apparent to those skilled in the art and guided by the teachings herein provided, that each of first framing member 14 and second framing member 16 may have any suitable length, as required by the size of the structure and the system application.

A second plurality of operatively connected platform modules 12 can be suspended or supported from the structure and positioned laterally adjacent the first plurality of platform modules 12, as shown in Figs. 9 and 10, such that first framing member 14 of platform module 12 contacts or approaches second framing member 16 of the laterally adjacent platform modular 12. Laterally adjacent platform modules 12 can be connected using a connecting bracket or other suitable mechanical connection. Additionally, a closure element 98 can be "snap-fitted" into a space formed at a connection of adjacent platform modules 12, as shown in Fig. 9. Closure element 98 contains debris, including hazardous materials such as lead-paint. Further, in one preferred embodiment of this invention, a panel, for example wood or a containment tarp 99, such as shown in Fig. 10, is positioned across the laterally adjacent platform modules 12 to maintain a tight seal between the platform modules 12 to contain debris and/or environmentally hazardous materials, such as lead paint

removed from the structure. As shown in Fig. 10, containment tarp 99 is preferably flexible to connect laterally adjacent platform modules 12 that are not level, or stepped, as a result of the structure or its support stringers being angled or sloped. One suitable material for containment tarp 99 is a reinforced plastic material having a thickness of about 6 mils. It should be apparent to those having ordinary skill in the art and guided by the teachings herein that other materials are suitable for containment tarp 99.

In one preferred embodiment of this invention, modular platform system 10 is installed on a structure, such as a highway or road bridge, having a plurality of support beams or stringers generally parallel the longitudinal centerline of the bridge along the length of the bridge. Modular platform system 10 is preferably, but not necessarily, installed laterally across the bridge, i.e. generally perpendicular to the length of the support beams or stringers. Modular platform system 10 including a plurality of operatively connected platform modules 12 is temporarily suspended with respect to the underside of the bridge, for example using a crane or other suitable machinery positioned on a top or road surface of the bridge. With modular platform system 10 positioned with respect to the underside of the structure, the modular platform system 10 is suspended with respect to at least one structure support beam or stringer. For example, the platform module 12 is secured to the structure. First framing member 14 is removably mounted to a first support beam or stringer using suspension member 20. Similarly, second framing member 16 is removably mounted

to the first support beam or stringer using suspension member 20. Preferably, each of first framing member 14 and second framing member 16 is suspended with respect to the structure using adjustable suspension members 20 so that the distance between panel 18 and the underside of the bridge can be adjusted according to the work scheduled on the bridge.

Platform module 12' is extended from the first position below platform module 12 to the second or extended position linearly aligned with platform modular 12. Platform module 12' is suspended from the structure. First framing member 14' and second framing member 16' are removably mounted to the support beam or stringer using suspension member 20. With platform module 12' in the second position and in linear alignment with platform module 12, platform module 12' can be connected or attached to platform module 12 using a suitable mechanical connection. For example, first framing member 14' can be fastened or connected to first framing member 14 and second framing member 16' can be fastened or connected to second framing member 16 using a connecting bracket.

A second modular platform system, preferably the same or similar to the first modular platform system, is constructed with respect to the structure. For example, the second modular platform system can be suspended with respect to the structure laterally adjacent the first modular platform system comprising a plurality of operatively connected platform modules. The second modular platform system can be suspended with respect to the structure as the first modular platform system is

suspended. Preferably, second modular platform system is connected to the first modular platform system using any suitable mechanical connections. For example, in order to provide for containment of debris removed from the structure, wood pieces and/or tarp pieces can be positioned at the abutting framing members to provide containment or seal spaces between adjacent framing members.

In one preferred embodiment of this invention, modular platform system 10 may be suspended from support stringer 110, at a first vertical distance to preform one process, such as sandblasting, and then lowered or raised to a second vertical distance with respect to support stringer 110 to perform another process, such as painting. For example, a threaded rod extension coupled to a coupler nut can be connected with respect to the structure. In one embodiment of this invention, the coupler nut can be rotated to allow a plate securing each structure to a beam flange to be rotated by a suitable rotational distance, for example about 180°, to allow the panel structure to be raised or lowered with respect to the beam flange in order to continue work on the structure, if desired. The coupler nut or other suitable mechanical connection can also prevent or limit damage to the threaded rod extension as a result of processes such as sandblasting and painting. It is apparent that suitable mechanical connections may be used to secure the structures directly or indirectly to the support surface.

In one embodiment of this invention, a counter-balancing weight 101 such as shown in Fig. 7, for example a suitably-sized concrete block, can be

positioned on one end portion of modular platform system 10 so that the modular platform system 10 is cantilevered over the edge portion of the bridge. Adjustments can be made, for example in increments of about 6 inches, with respect to balancing modular platform system 10 by positioning the counter-balancing weight with respect to a length of modular platform system 10. Thus, one counter-balancing weight can handle a variety of loads by moving the weight along a length of modular platform system 10.

If modular platform system 10 spans a hard surface, for example a road or highway, modular platform system can be suspended with respect to the structure from the surface below. For example, a rough terrain scissors lift or other suitable machine can move or lift modular platform system 10 into position with respect to the structure and suspension members 20 may be connected to beam clamps 80 properly positioned on the support stringers of the structure to suspend modular platform system 10 with respect to the structure.

In one embodiment of this invention, platform module 12 comprises an absorbing layer of plywood applied over deck panels 18 to protect platform module 12 so that modular platform system 10 is reusable. The plywood panels or sheets absorb the weight of concrete pieces dropping onto modular platform system 10 during demolition, for example. Further, tight seals can be formed using the plywood to contain lead-base paint dust, for example, created during sand blasting or shot blasting procedures. Preferably, but not necessarily, the plywood sheets are attached

to modular platform system 10 by nailing the plywood and/or plywood clamping strips to wood, for example pieces of standard 2x4s, positioned within each framing member. Preferably, the pieces of wood are inserted into the rolled shape of the framing member. It is apparent to those skilled in the art that any suitable mechanical connection may be used to secure the plywood sheets to the platform panels. For example, the top piece of plywood may clamp a 4 foot standard width plywood piece in place.

Preferably, but not necessarily, platform module 12 may further comprise at least one adjustable strut spacer 97, such as shown in Fig. 11, having a first end portion connected with respect to first framing member 14 and a second end portion connected with respect to second framing member 16. Strut spacer 97 provides increased strength and rigidity to the platform module 12, particularly when platform module 12 is subjected to large loads.

Referring to Figs. 13 and 14, in one embodiment of this invention, a guard rail system 120 suitable for adhering to government safety standards, such as O.S.H.A., is connected to modular platform system 10. Guard rail system 120 preferably comprises a plurality of posts 122 positioned within and secured to first framing member 14 and/or second framing member 16. A chain or cable 124 extends between the posts 122 to provide perimeter protection and prevent workers from falling from the side of modular platform system 10. As shown in Fig. 14, posts 122 are positioned within and secured to framing member 14, 16 using a bolt and nut

combination. For example, bolt 126 is threadedly connected to a bottom portion 128 of post 122. Bolt 126 is rotatable with respect to a plate or bracket 130 positioned within the framing member to tighten and secure post 122 with respect to the framing member. It should be apparent to those skilled in the art and guided by the teachings herein that other suitable mechanical connections may be used to secure each post 122 to the corresponding framing member 14, 16.

In one preferred embodiment of this invention as shown in Fig. 15, platform module 212 comprises a first framing member 214 suspended with respect to the structure, and a second framing member 216, the same or similar to first framing member 214, suspended with respect to the structure and mounted with respect to first framing member 214. At least one suspension member 220 is used to suspend each of first framing member 214 and second framing member 216 with respect to the structure 100. Referring to Fig. 15, at least one suspension member 220 is connected or attached between first framing member 214 and the structure 100. Similarly, at least one suspension member 220' is connected or attached to second framing member 216 and removably mounted with respect to the structure. In the figures, suspension member 220 and suspension member 220' may be shown according to different embodiments of this invention. However, it should be apparent to those having ordinary skill in the art that suspension member 220 may be the same or similar to suspension member 220'.

Suspension member 220 may comprise a threaded rod 221 connected

at a first end portion 222 to one of first framing member 214 and second framing member 216, and at a second end portion 224 to the structure. A lower bracket 225 is positioned at a first edge surface 215 of first framing member 214. A nut 226 is threadedly connected to an end portion of threaded rod 221 to maintain lower bracket 225 in contacting relation with first edge surface 215. Preferably, but not necessarily, nut 226 is positioned within a cavity 227 formed by first framing member 214. An upper bracket 229 is positioned at a second edge surface 217 of first framing member 214 and a nut 230 is threadedly connected to threaded rod 221 to maintain upper bracket 229 in contacting relation with second edge surface 217. Nut 226 and nut 230 are rotatable with respect to each other about threaded rod 221 to tighten or secure suspension member 220 to first framing member 214. Further, nut 226 can be positioned along a length of threaded rod 221 to position first framing member 214 at a desired position or distance with respect to the structure 100.

A similar mechanical connection can be used to secure second end portion 224 to the structure 100. For example, as shown in Fig. 15, an upper bracket 232 is positioned at second end portion 224. A nut 234 is threadedly connected to second end portion 224 to maintain upper bracket 232 in contacting relation with a top surface of support stringer 110. A lower bracket 236 is positioned at a bottom surface of support stringer 110 and a nut 238 is threadedly connected to threaded rod 221 to maintain lower bracket 236 in contacting relation with the bottom surface of support stringer 110. Nut 234 and nut 238 are rotatable with respect to each other about

threaded rod 221 to tighten or secure suspension member 220 to support stringer 110. Further, nut 238 can be positioned along a length of threaded rod 221 to position first framing member 214 at a desired position or distance with respect to the structure 100.

Second suspension member 220' can be the same or similar to first suspension member 220. Alternatively, second suspension member 220' comprises a chain or cable 240 having a first connection, such as hook 242, positioned at a first end portion 244 and a second connection, such as hook 246, positioned at a second end portion 248, as shown in Fig. 15. Hooks 242 and/or 246 allow the framing members to be suspended from the support stringers quickly and easily. Preferably, each hook 242, 246 comprises a pivot arm to allow the hook to "snap" connect with a corresponding loop fastener. Cable 240 may have any suitable length to suspend second framing member 216 at a desired position or distance with respect to support stringer 110. Preferably, the length of cable 240 is adjustable. A loop fastener 250 is secured to second framing member 216. For example, loop fastener 250 may be threadedly connected to a bolt 252 that is secured to second framing member 216. As shown in Fig. 15 for example, a bracket 254 is in contacting relation with a first edge surface 255 of second framing member 216. Preferably, but not necessarily, bracket 254 and a head portion 253 of bolt 252 is positioned within a cavity 257 formed by second framing member 216. Loop fastener 250 and bolt 252 are rotatable with respect to each other to tighten or secure suspension member 220' to second framing

member 216.

A similar mechanical connection can be used to secure second end portion 248 to the structure 100. For example, as shown in Fig. 15, an upper bracket 256 is in contacting relation with a top surface of support stringer 110. A lower bracket 258 is positioned at a bottom surface of support stringer 110 and a hoop fastener 260 is threadedly connected to a bolt 262 to maintain lower bracket 258 in contacting relation with the bottom surface of support stringer 110. Hoop fastener 260 and bolt 262 are rotatable with respect to each other to tighten or secure suspension member 220' to support surface 110.

In one preferred embodiment of this invention, at least one channel trolley 270 is mounted with respect to platform module 212. Channel trolley 270 can be connected to platform module 212 using any suitable connection, such as a weld or a suitable mechanical arrangement. Preferably, at least one channel trolley 270 is connected to each of first framing member 214 and second framing member 216, as shown for example in Fig. 15. Rotatable wheels 272 are positionable within a channel formed by a framing member to allow relative movement of a framing member with respect to an adjacent or operatively connected framing member.

The modular platform system of the present invention provides quick deployment and installation of the system, thereby decreasing costs associated with project set-up and labor charges. Further, the containment means can be used where government regulations and restrictions must be satisfied, such as when removing

lead-based paint from the structure. The modular platform system of the present invention can be used in general construction projects for demolition and/or inspection by inspectors or foreman, for example. Additionally, the modular platform system of the present invention can be used within an industrial or manufacturing facility. The modular platform system can be temporarily or permanently suspended from ceiling trusses to permit work to be performed above equipment and machinery without the need to shut down the equipment or delay the manufacturing processes, for example.

While in the foregoing specification this invention has been described as a modular platform system suspendable with respect to a support structure of a bridge construction, this invention is also suitable for other purposes, such as a suspended building ceiling, capable of supporting dynamic loads, such as people, and/or static loads, such as cables and wires.

While in the foregoing specification this invention has been described in relation to certain preferred embodiments thereof, and many details have been set forth for purpose of illustration, it will be apparent to those skilled in the art that the invention is susceptible to additional embodiments and that certain of the details described can be varied considerably without departing from the basic principles of the invention.